

that there was an excess of precipitation over the larger part of the district.

#### WIND.

The prevailing direction of the wind was from the northwest in the northern part of the district, and from the southeast and southwest in the southern part.

#### RIVERS.

Heavy rains in southeastern Minnesota, southwestern Wisconsin, northwestern Illinois, and northeastern Iowa, during the first half of the month, caused a decided rise in the stage of the rivers in those sections. Mr. James H. Spencer, local forecaster, Dubuque, Iowa, reports:

The heavy rains raised the Mississippi River at Prairie du Chien, Wis., from 0.6 foot on the 1st to 4.3 feet on the 18th, after which date it fell steadily to 1 foot on the 31st. At Dubuque the river rose from 1.1 feet on the 1st to 5 feet on the 15th, after which date it fell steadily to 1.7 feet on the 31st. From Dubuque to La Crosse, Wis., the Mississippi ranged considerably higher than during August, 1910, and there was sufficient water for navigation during the entire month. The Wisconsin River was decidedly higher than during August, 1910. The flood on the upper Iowa River was one of the worst on record, and the damage amounted to thousands of dollars. It was a double rise, the first occurring on the 13th, from heavy rains throughout the valley, and the second on the 14th, from exceptionally heavy rains at and near Le Roy, Minn. The Decorah, Iowa, Republican states that "Bridges, houses, barns, farm animals, and grain are wrecked, burned, killed, or washed away," as a result of the storm and flood; it also reports that the river at Decorah was the highest in 40 years. The postmaster at New Albion, Iowa, writes: "The flood on the upper Iowa River was within 6 inches of the highest watermark known. Crops are damaged through the valley very materially. The outlook before the flood for corn and hay was never better; now there is no hay to cut, and corn will be reduced 50 per cent, and possibly more. No lives were lost, but horses, cattle, and hogs were swept down the stream. One bridge, 10 miles from here, was washed away."

Mr. J. M. Sherier, local forecaster, in charge of the Davenport River district, reports:

The crest of the rise passed Clinton and Davenport on the 14th, and Muscatine on the 15th, when the gauge readings were from 5.4 feet to 5.6 feet higher than those recorded during the first few days of August. The highest stages recorded were as follows: Davenport, 6.1 feet; Clinton, 6.3 feet; Muscatine, 7 feet. The river fell rapidly after the passage of the crest of the rise, and at the close of the month the stream was again so low that navigation of the Le Claire Rapids was extremely difficult.

The Des Moines River, at Des Moines, Iowa, showed but little variation during the month; the stage was 1.4 feet from the 1st to the 5th; 1.6 feet from the 6th to the 12th; and 1.5 feet from the 13th to the 31st. The flow of the upper Illinois River was about normal.

#### SEVERE LOCAL STORMS.

There were more severe electrical, wind, and heavy rainstorms during the month than are usual in August.

A severe storm passed from west to east over western Bottineau County, N. Dak., which resulted in the death of three persons, and many thousand dollars' worth of property was destroyed. Another storm passed over Divide County, which resulted in the death of two men, and the destruction of much property. Unusually violent thunderstorms occurred at Worthington, Nobles County, Minn., on the 10th, destroying a number of head of live stock, a barn, and several grain stacks, with a total loss of over \$1,500. The courthouse was struck by lightning and severely damaged. At Benson, Swift County, Minn., two people were killed by a small tornado on the 13th, and considerable property destroyed in that vicinity. At Grand Meadow, Mower County, Minn., on the night of the 12th-13th, a terrific thunderstorm pre-

vailed all night, attended by destructive lightning and rainfall. Mr. C. F. Greening, cooperative observer at that place, reports under date of August 13:

The heaviest 12-hour rainfall in 40 years began at 9.30 p. m. on the 12th and ended at 8.30 a. m. on the 13th, during which time 6.41 inches of rain fell. A terrific thunderstorm prevailed all night. The railroad track was washed out and the country flooded. The Chicago Great Western depot at Racine and a house in Spring Valley were struck by lightning and burned. Deer Creek, near this village, was dry a week ago, but is one-half mile wide this morning, and hundreds of shocks of wheat, oats, flax, rye, and timothy were washed away, fences were torn out and are hanging by the wires. Many stacks of grain are standing in several feet of water. The damage is great, as not half of the stacking has been done yet. The total rainfall for the past 14 days—July 31 to August 13—is 15.26 inches. The total rainfall for 1910 at this station was 16.91 inches, or only 1.65 inches more than for the last 14 days.

The official in charge, local office, United States Weather Bureau, Dubuque, Iowa, reports:

No August in 60 years or more has produced such severe local thunderstorms in this vicinity as the past month. That of 10th-11th was the heaviest at Dubuque. The first thunder was heard at 5.12 p. m., when the sky was only about one-half overcast. The sky, particularly the northern half, was so black and threatening at 6.45 p. m. that buildings a block away could hardly be seen. From 6.30 p. m. to 10 p. m. very heavy thunder and exceedingly vivid lightning occurred at intervals. It is probable that such a long period of exceptionally severe thunder and lightning has seldom or never been experienced at this station. The storm did not end until the morning of the 11th. Lightning struck several buildings, but the damage in all cases was slight. The total rainfall during this storm was 3.64 inches. It is the heaviest 24-hour rainfall ever recorded here in August. Rainfall was nearly continuous during the entire night. In many cases cellars were flooded, and there were numerous and severe washouts on the railroads entering Dubuque. Telegraph and telephone companies suffered severely as the result of lightning, rain, and wind. All Western Union and Postal wires to Chicago were down and 2 or 3 days were required for complete recovery. Hundreds of telephones were put out of commission. The Mississippi River at Dubuque rose 1.7 feet during the storm. Considerable damage was done to corn, some of which was beaten down by wind and rain. Severe local storms were common throughout northeastern Iowa from the 9th to the 16th.

Mr. Clarence J. Root, section director, Springfield, Ill., reports as follows in regard to severe local storms in Illinois:

A series of thunderstorms occurred from the 7th to the 12th. The storms of the evening of the 10th seemed to be the worst in the northern counties, while the severe storms in the central part of the State occurred on the 7th. On the evening of the 10th severe and damaging thunderstorms occurred throughout the two northern tiers of counties. It is impossible with the scattered reports received at this office to properly describe the extent and damage from these storms. The amounts stated in the reports received at this office aggregate \$75,000, so it is safe to conservatively estimate the total loss in northern Illinois at several hundred thousand dollars. While there was considerable loss from flood and wind the greatest damage resulted from lightning.

Stephenson County: Severe electrical storms raged from the evening of the 10th to the morning of the 11th and also on the 12th. These storms caused 25 to 30 fires, resulting in loss of grain, stock, and buildings. Trees and chimneys were blown down, many buildings were struck by lightning, and a number were burned, including several grain elevators. Some animals were killed by lightning in the fields. Old residents state that it was the worst storm in years.

Carroll County: Mr. M. N. Wertz, cooperative observer at Lanark, reports an unusually severe storm in that vicinity on the 10th-11th. The wind uprooted trees, tore down signs, and littered the ground with limbs. The lightning was unusually severe. Mr. Wertz says, in part, "From 7.45 p. m. August 10, to 5 a. m. August 11, 5.01 inches of rain fell, being the greatest rainfall in that length of time ever recorded at this station. The electrical display was something grand, as there was a continuous display of lightning, and it was one of the grandest sights I ever witnessed, from 8 p. m. to midnight." The Waukarusa River rose rapidly, cellars were flooded, and some poultry and hogs were drowned. The Chicago, Milwaukee & St. Paul tracks were washed out in several places, and telephone lines were put out of commission. So many fires from lightning were never before known in one month.

McHenry County: Mr. John West James, cooperative observer at Riley, says: "During the thunderstorm of the evening of the 10th nearly a dozen buildings were struck and burned in the vicinity; damage estimated, \$25,000. No lives lost, but considerable stock was

killed in the fields." Electric interurban lines suffered from wash-outs and wire trouble.

Kane County: During the storm of the 19th buildings were struck by lightning in Aurora, St. Charles, and Elgin. Some fires resulted, including a \$40,000 loss to the Elgin Academy. A second storm at Aurora on the 15th caused more damage from lightning and fire. Considerable stock was killed throughout the county by lightning and barn fires. Electric railways and telephone lines suffered.

In central Illinois the worst storms occurred on the 7th and 9th.

Storms of the 7th: At Chandlerville, in Mason County, two lumbermen sleeping in a tent were killed by a falling tree. In Macoupin County much damage was caused by wind and lightning. Many animals were killed, farm buildings were damaged or destroyed, and the corn crop was injured. The interurban wires were broken by falling limbs. At Pana and Edinburg lightning struck barns and caused fires, with loss of grain and stock. A severe storm at Litchfield damaged trees, wires, and buildings. In the vicinity of Springfield a house and barn were struck by lightning, the barn being destroyed. Considerable damage resulted to traction, telegraph, and telephone lines and heavily laden fruit trees. At White Hall much damage resulted from wind; buildings, trees, cornfields, gardens, and orchards all suffering. A 4-year old child, living at Jerseyville, was killed by a live wire, and several persons were more or less injured in the path of the storm through Green and Macoupin Counties.

A storm on August 9 caused damage from wind and lightning in Sangamon, McLean, and Macon Counties. Telephone wires were all down in the vicinity of Springfield. Mr. S. P. Peterson, observer in charge at La Salle, Ill., writes: "During the night of the 11th and 12th a very severe thunderstorm occurred. Many buildings in this vicinity were struck by lightning and a few were burned to the ground. The heavy rainfall attending this storm, 2.22 inches, washed out a portion of the Rock Island tracks near Marquette, Ill., causing a wreck."

#### REPORT OF SEVERE LOCAL STORM, GALENA, ILL., ON AUGUST 16, 1911.

[By J. H. SPENCER, Local Forecaster, United States Weather Bureau, Dubuque, Iowa.]

This local storm was one of the severest ever recorded in this immediate section of the country, and it seems almost a miracle that no one was killed. The storm clouds were low and black, and moved swiftly. Observers in the path of the storm who saw it approaching say that buildings and other objects seemed enveloped in black smoke, and that the appearance of the storm in general was terrifying. The storm entered the city at its western outskirts about 4.30 p. m., and it was severe only for a few minutes—perhaps 10. It came from a west-northwest direction, and passed over the southern section of the city. Its path was about one-half mile wide and perhaps 2 miles long. It did not do much damage until it reached the river, when, according to some observers, it united with another storm of less severity that was moving down the Galena River Valley from the northeast. The storm then moved forward with increased force, and for a distance of nearly 2,000 feet it was destructive. No funnel-shaped cloud was visible, and trees in Grant Park and elsewhere were laid down in the same direction as the storm was traveling. A number of windows and doors were blown inward, but none outward. Roofs, barns, sheds, branches from trees, etc., were carried slightly south of east as a rule.

At the Grant Memorial Home, however, there was some evidence of rotary motion. A large section of the massive roof of this brick building was taken off by the wind and carried through large trees for a distance of 175 to 200 feet; it was about 30 feet wide by 40 feet long and weighed many tons. Part of it was blown nearly northeast, where it struck and practically destroyed the frame McCarthy dwelling, in which several persons were living at the time; no one was seriously injured. Another section of the roof, comprising the tin and some timbers, was carried slightly south of east across the street into a yard, where it demolished a fence, several trees, and barely missed a dwelling. A third and smaller section struck the Avery house, the

roof of which was damaged, either from this cause or by the wind. The Avery home is midway between the McCarthy home and the yard referred to. The writer saw timbers from the Grant roof that were 16 feet long and 4 by 8 inches or 8 by 8 inches; there were several of them, and none landed less than 175 feet from the building.

A 30 by 70 foot section of the roof of the Illinois Central freight house was blown off. Several windows and doors of this brick building were blown inward, and the walls were cracked in several places. A 16-foot board from the freight house was taken through the air for a distance of 500 to 600 feet and dashed into the shingle roof of the town hall.

On the other side of the river the chimneys and roof of the Burlington Hotel were damaged; the air dome, a large tent, was blown over and badly torn; and a portion of the brick walls of a blacksmith shop was blown over.

Telephone and telegraph companies suffered much loss. Scores of poles and quantities of wire were blown down.

A few large and sound trees were uprooted. In Grant Park one elm 15 inches in diameter was forced halfway to the ground, several box elders and catalpas were uprooted, and severe damage was done to many other trees. At 702 Park Avenue a box elder 23 years old and 6 feet in circumference was uprooted and thrown to the ground. Hundreds of trees throughout the area covered by the storm suffered severe damage. After the storm, Spring Street, in particular, was practically impassable to teams, owing to fallen trees, poles, etc.

There was heavy rainfall, but it was of brief duration. Hail fell during the storm, but the stones were too small to cause damage. The lightning was severe, and it struck the Meller residence on Hill Street, causing damage to the extent of \$150.

The total loss from the storm is estimated at not less than \$5,000.

#### ENGINEERING NOTES.

[Work being done in Iowa by United States and Iowa Geological Surveys.]

Mr. Robert Follansbee, district engineer, water resources branch, United States Geological Survey, St. Paul, Minn., has kindly furnished the following, relative to work being done in Iowa by the Iowa Geological Survey, in cooperation with the United States Geological Survey, in connection with the conservation and development of the water-power possibilities in that State:

The Iowa Geological Survey, under the directorship of Prof. Geo. F. Kay, of Iowa City, has recently entered into cooperation with the United States Geological Survey for the purpose of studying the flow of the more important rivers in the State. Prior to 1906 a number of stations were maintained by the United States Geological Survey, but with one exception they were discontinued in that year for lack of funds. Within the past year or two, water-power possibilities have aroused interest in Iowa and the State survey has been anxious to prepare a report on this subject. Preliminary investigations, however, showed the need for actual records of river discharge before a definite report could be made and so this has been postponed for some time, pending the compilation of stream-flow data. As a result, the following stations have been established: Iowa River, near Iowa Falls; Des Moines, near Fort Dodge; Des Moines, at Keosauqua; Cedar, at Cedar Rapids; Wapsipinicon, at Stone City. The last three stations were originally established by the United States Geological Survey prior to 1906 and records of varying length are available for them. For the Cedar and Wapsipinicon, the records have been continued uninterruptedly since 1903.

Not only will the records of the Iowa Rivers be of value for water-power purposes but also for flood prevention, as the river valleys are subject to severe overflow. Also the subject of the pollution of the streams by sewage is becoming increasingly important and in this connection the low-water records are valuable in indicating the allowable degree of pollution of the streams.